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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/529,492	03/29/2005	Yasushi Enokido	268827US2PCT	9162
22850	7590	11/18/2005	EXAMINER	
OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C. 1940 DUKE STREET ALEXANDRIA, VA 22314			PEACE, RHONDA S	
			ART UNIT	PAPER NUMBER
			2874	

DATE MAILED: 11/18/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No. 10/529,492	Applicant(s) ENOKIDO, YASUSHI	
	Examiner Rhonda S. Peace	Art Unit 2874	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☐ Responsive to communication(s) filed on ____.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-14 is/are pending in the application.
4a) Of the above claim(s) ____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) ____ is/are allowed.
- 6) ☒ Claim(s) 1-3 and 5-7 is/are rejected.
- 7) ☒ Claim(s) 4, and 8-14 is/are objected to.
- 8) ☐ Claim(s) ____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☒ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 March 2005 is/are: a) ☐ accepted or b) ☒ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
a) ☒ All b) ☐ Some * c) ☐ None of:
- ☐ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. ____.
 - ☒ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input checked="" type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413)
Paper No(s)/Mail Date. ____. |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date <u>3/29/05 & 6/22/05</u> . | 6) <input type="checkbox"/> Other: ____. |

DETAILED ACTION

Priority

Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file of this National Stage application from the International Bureau (PCT Rule 17.2(a)).

Information Disclosure Statement

The information disclosure statements (IDS) submitted on 3/29/2005 and 6/22/2005 were filed in compliance with the provisions of 37 CFR 1.97. Accordingly, the information disclosure statements are being considered by the examiner.

Drawings

The drawings are objected to because they contain the following that make the drawing unsuitable for publication: handwritten figure labels, stray marks, Japanese characters, and uneven shading of lines. Corrected drawing sheets in compliance with 37 CFR 1.121(d) are required in reply to the Office action to avoid abandonment of the application. Any amended replacement drawing sheet should include all of the figures appearing on the immediate prior version of the sheet, even if only one figure is being amended. The figure or figure number of an amended drawing should not be labeled as "amended." If a drawing figure is to be canceled, the appropriate figure must be removed from the replacement sheet, and where necessary, the remaining figures must

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be renumbered and appropriate changes made to the brief description of the several views of the drawings for consistency. Additional replacement sheets may be necessary to show the renumbering of the remaining figures. Each drawing sheet submitted after the filing date of an application must be labeled in the top margin as either "Replacement Sheet" or "New Sheet" pursuant to 37 CFR 1.121(d). If the changes are not accepted by the examiner, the applicant will be notified and informed of any required corrective action in the next Office action. The objection to the drawings will not be held in abeyance.

Specification

The abstract of the disclosure is objected to because it contains numbers referring to elements within the Figures. Correction (the removal of these elemental references) is required. See MPEP § 608.01(b).

Claim Objections

Claims 11-14 are objected to under 37 CFR 1.75(c) as being in improper form because a multiple dependent claim, such as claims 11-14, cannot depend from another multiple dependent claim, such as claims 7, and 9-12. See MPEP § 608.01(n). Accordingly, the claims 11-14 have not been further treated on the merits.

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-3, 6, and 7 are rejected under 35 U.S.C. 102(e) as being anticipated by Kittaka et al (US 2002/0197042).

With regards to claims 1-3, 6, and 7, Kittaka et al discloses a two-dimensional photonic crystal having a tetragonal lattice comprising a prism-shaped first dielectric area **B** arranged at each lattice point of the tetragonal lattice, a prism-shaped second dielectric area **C** arranged at the approximate center of the tetragonal lattice, and a prism-shaped third dielectric areas **A** and **D** arranged adjacent to and around the first and second dielectric areas (paragraph 0083, Figure 10). All four areas, **A**, **B**, **C**, and **D**, can be formed using different materials, including titanium oxide ($\epsilon = 40-50$), silicon ($\epsilon = 11-12$), tantalum oxide ($\epsilon = 11.6$), niobium oxide, and air, all having different dielectric constants, the values of which are well known (paragraphs 0083, 0129, and 0146-0151). For example, the disclosure of Kittaka et al supports a structure (as the main requirement for the materials used is that they secure transparency in an operating wavelength range) where **B** is chosen to be formed of silicon, having a well known dielectric constant of 11-12, and **C** is chosen to be formed of titanium oxide, having a

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well known dielectric constant of 40-50, thereby creating a structure where ϵ_1 , the dielectric constant of the first area **B**, is less than ϵ_2 , the dielectric constant of the second area **C** (paragraphs 0129-0130). Moreover, the disclosure of Kittaka et al supports a structure where **D** is chosen to be formed of titanium oxide, having a well known dielectric constant of 40-50, and **B** is chosen to be formed of air, thereby creating a structure where ϵ_3 , the dielectric constant of the third area **D**, is greater than ϵ_1 , the dielectric constant of the first area **B** (paragraphs 0129 and 0146-0151).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

The factual inquiries set forth in *Graham v. John Deere Co.*, 383 U.S. 1, 148 USPQ 459 (1966), that are applied for establishing a background for determining obviousness under 35 U.S.C. 103(a) are summarized as follows:

1. Determining the scope and contents of the prior art.
2. Ascertaining the differences between the prior art and the claims at issue.
3. Resolving the level of ordinary skill in the pertinent art.
4. Considering objective evidence present in the application indicating obviousness or nonobviousness.

Claim 5 is rejected under 35 U.S.C. 103(a) as being unpatentable over Kittaka et al (US 2002/0197042) in further view of Cotteverte et al (US 6542682).

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Pertaining to claim 5, Kittaka et al disclose the two-dimensional photonic crystal as described above, including the use of air as materials A and B, the third and first dielectric areas (paragraphs 0129 and 0149-0151). However, Kittaka et al does not disclose an arrangement where the first and second areas (B & C) are arranged to have the same relative dielectric constants. Cotteverte (US 6542682) discloses a three dimensional photonic crystal having a tetragonal lattice, where each of the first and second dielectric areas, those arranged at the lattice points, or in the center of the corresponding lattice, are filled with air (Figure 1, column 1 lines 34-44). This is a common method by which to form photonic crystals, using cylindrical vias filled with air to act as dielectric areas, and is well known in the art, in teachings other than Cotteverte et al. It would have ^{been} ~~obv~~ obvious to one of ordinary skill in the art to combine the teachings of Cotteverte et al and Kittaka et al to form a photonic crystal where the first and second areas are filled with air, so as to have equal relative dielectric constants, as this is a procedure well known in the art, and allows the user to further specialize the device of Kittaka et al to their particular application.

Allowable Subject Matter

Claims 4, and 8-10 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims.

The following is a statement of reasons for the indication of allowable subject matter: The applicable prior art does not disclose, nor does it reasonably suggest, a

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two-dimensional photonic crystal where a first and second substantially cylindrical dielectric areas (whose limitations such as placements are discussed within claim 1) satisfy the following relationship as is required in claim 4:

$$0.4a \leq r_1 + r_2 \leq 0.6a$$

where a represents a unit length of the lattice axis, r_1 indicated the radius of the first dielectric area, and r_2 represents the radius of the second dielectric area.

Furthermore with regards to claim 8, the applicable prior art does not disclose, nor does it reasonably suggest, a two-dimensional photonic crystal where a first, second, and third dielectric areas, having dielectric constants ϵ_1 , ϵ_2 , and ϵ_3 , respectively, satisfy the following relationships:

$$(\epsilon_3 > \epsilon_1), \text{ and } (\epsilon_2/\epsilon_1 > 20).$$

Moreover, and pertaining to claims 9 and 10, the prior art does not disclose the use of ceramic as a dielectric material in a two-dimensional photonic having the structure necessitated by the limitations of the independent claim.

Conclusion

The prior art made of record and not relied upon is considered pertinent to applicant's disclosure. Kitagawa et al (US 6931191) discloses a photonic crystal device having a variable band gap. Hansen et al (US 2005/0238307) discusses a non-linear optical fibre utilizing a photonic crystal. Libori et al (US 2005/0069269) discloses a dual core photonic crystal fiber with special dispersion properties. Nakazawa et al (US 6914715) discloses a photonic crystal having a repetitious periodic structure in two


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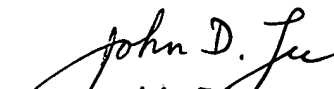
dimensions. Borrelli et al (US 6496632) discusses methods of fabricating photonic structures. Reynolds (US 6618535) discusses a photonic band gap device using coupled defects. Sigalas et al (US 6728457) discloses slab photonic crystals with non-circular holes.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Rhonda S. Peace whose telephone number is (571) 272-8580. The examiner can normally be reached on M-F (8-5).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Rodney Bovernick can be reached on (571) 272- 2344. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).


Rhonda S. Peace
Examiner
Art Unit 2874


John D. Lee
Primary Examiner